

implies that the dragonflies considered the spinning wheels as something worth stalking or, at least, pursuing. In one of my experiences, the reflections from the transparent wings of the accompanying *Anax* dragonfly reminded me very much of a spinning wheel. Perhaps the flashes of light reflected from the spinning spokes resemble a dragonfly's wings' flashes on the retina of the stalking dragonfly.

In the case of the large, solitary *Anax* species, which

are active even at dusk, this could be a preliminary means of mate recognition.

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16. ABUNDANCE AND DIVERSITY OF ODONATA (INSECTA) IN SOME HILLY REGIONS OF TAMIL NADU

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Introduction

Fraser (1933, 1934, 1936) recorded 116 species of Odonata (Insecta) from the hilly regions of India. A perusal of literature (Miller 1992; Gunathilagaraj *et al.* 1999; Palot and Soniya 2000a,b; Asaithambi and Manickavasagam 2002; Emiliyamma and Radhakrishnan 2003; Kandibane *et al.* 2005; Sharma *et al.* 2007) showed that there has been no comprehensive study on the abundance and diversity of this group from the hilly regions of Tamil Nadu. Hence, the present study was conducted to assess the diversity and abundance of Odonata in five hilly regions of Salem district in Tamil Nadu.

Methodology

Five hilly regions, namely Yercaud, Karunkaradu, Pallikaradu, Periakaradu and Poonaikundru were surveyed to assess the Odonata diversity and abundance. The place of sampling and coordinates of the hilly regions are given in Table 1. Collections were made once after the North-east monsoon (January to April, 2006), and only adults were collected with the aid of sweep net (35 cm dia. and 70 cm

ht.). In Yercaud, collections were made from small streams, tributaries of Kiliyanur River and from boat house lake. Karunkaradu, Pallikaradu, Periakaradu and Poonaikundru were devoid of water bodies and collections were made with a sweep net by slowly walking around the hills. The identity of collected Odonata was fixed using the keys developed by Fraser (1933, 1934, 1936), Kumar and Prasad (1981), Ram *et al.* (1982), Barrion and Litsinger (1994), and Emiliyamma and Radhakrishnan (2000). Odonata diversity was computed using the Simpson's index (Simpson 1949).

$$\text{Simpson's index } (\lambda) = \frac{\sum_{i=1}^s n_i(n_i-1)}{N(N-1)}$$

Where, n_i is the number of individuals of the i^{th} species, and N is the total number of individuals in the sample
 Simpson's index (λ) varies from 0 to 1. Increase in the value of the index indicates decrease in the diversity of species and vice-versa.

Abbreviations used: dia. - diameter; ht. - height

Table 1: Coordinates of the hilly regions sampled in the present study

Hill	District	Altitude (m)	Latitude	Longitude	Shade cover	Water bodies
Yercaud	Salem	1,500	11° 48' N	76° 13' E	High	Present
Karunkaradu	Bukkampatty, Salem	220	11° 19' N	77° 40' E	Low	Absent
Poonaikundru	Bukkampatty, Salem	200	11° 19' N	77° 40' E	Low	Absent
Pallikaradu	Bukkampatty, Salem	200	11° 19' N	77° 40' E	Low	Absent
Periakaradu	Bukkampatty, Salem	250	11° 19' N	77° 40' E	Low	Absent

Table 2: Distribution of Odonata in hill regions of Tamil Nadu

Name of the species	Hills					Total
	A	B	C	D	E	
Suborder: Anisoptera						
Libellulidae						
<i>Brachythemis contaminata</i>	7	-	-	-	-	7
<i>Bradinopyga geminata</i>	3	-	8	-	-	11
<i>Crocothemis servilia</i>	3	-	-	-	-	3
<i>Diplacodes nebulosa</i>	1	-	-	-	-	1
<i>Diplacodes trivialis</i>	12	8	12	12	15	59
<i>Lathrecista asiatica</i>	-	1	-	-	1	2
<i>Orthetrum sabina</i>	7	9	7	9	9	41
<i>Pantala flavescens</i>	9	4	4	3	6	26
<i>Potamarcha congener</i>	-	2	-	-	-	2
<i>Rhodothemis rufa</i>	2	-	-	-	-	2
<i>Tholymis tillarga</i>	4	-	-	-	-	4
<i>Tramea basilaris</i>	3	3	1	1	1	9
<i>Tramea limbata</i>	2	4	2	1	1	10
<i>Trithemis aurora</i>	3	-	-	-	-	3
Suborder: Zygoptera						
Coenagrionidae						
<i>Agriocnemis pygmaea</i>	4	-	-	-	-	4
<i>Ceriagrion coromandelianum</i>	6	3	-	-	-	9
<i>Ischnura aurora</i>	7	4	-	-	-	11
<i>Ischnura senegalensis</i>	4	-	-	-	-	4
<i>Pseudagrion decorum</i>	5	-	-	-	-	5
<i>Pseudagrion microcephalum</i>	4	-	-	-	-	4
<i>Pseudagrion rubriceps</i>	2	-	-	-	-	2
Lestidae						
<i>Lestes elatus</i>	-	15	-	-	-	15
Platycnemididae						
<i>Copera vittata</i>	17	-	-	-	-	17
Total	102	53	34	26	33	248

A : Yercaud C : Poonaikundru E : Periakaradu
 B : Karunkaradu D : Pallikaradu

Results

Odonata collected from 5 hilly regions comprised 23 species of Odonata (14 species of Anisoptera and 9 species of Zygoptera) belonging to 18 genera under 4 families (Table 2). Among the 23 species, *Diplacodes trivialis* (Rambur) (Libellulidae) and *Copera vittata* Selys (Platycnemididae) were the most abundant Anisoptera and Zygoptera respectively. Except Yercaud, all other hilly regions sampled were dominated by Anisoptera (dragonflies); Yercaud had both Anisoptera and Zygoptera in nearly equal proportions. No Zygoptera was recorded in Pallikaradu, Periakaradu and Poonaikundru. Libellulidae (Anisoptera) was the only family present in all hilly regions, whereas Zygoptera

Table 3: Diversity of Odonata (Simpson's index) in hilly regions of Tamil Nadu

Hilly region	Simpson's index
Yercaud	0.07
Karunkaradu	0.14
Poonaikundru	0.22
Pallikaradu	0.32
Periakaradu	0.30

was represented by three families, namely Coenagrionidae, Lestidae and Platycnemididae. Libellulidae had maximum number of individuals (180) and species (14), followed by Coenagrionidae (39 individuals and 7 species), Platycnemididae and Lestidae (1 species each; 17 and 15 individuals respectively). Of the five hilly regions sampled, Odonata abundance was maximum in Yercaud followed by Karunkaradu, Poonaikundru, Periakaradu and Pallikaradu. *Copera vittata* Selys (Platycnemididae) and *Lestes elatus* Hagen in Selys (Lestidae) were dominant in Yercaud and Karunkaradu hills respectively, and *Diplacodes trivialis* (Rambur) (Libellulidae) was dominant in the rest.

Brachythemis contaminata (Fabricius), *Crocothemis servilia* (Drury), *Diplacodes nebulosa* (Fabricius), *Tholymis tillarga* (Fabricius), *Trithemis aurora* (Burmeister), *Rhodothemis rufa* (Rambur) (Libellulidae), *Agriocnemis pygmaea* (Rambur), *Ischnura senegalensis* (Rambur), *Pseudagrion decorum* (Rambur), *Pseudagrion microcephalum* (Rambur), *Pseudagrion rubriceps* Selys (Coenagrionidae) and *Copera vittata* (Platycnemididae) were unique to Yercaud, whereas *Potamarcha congener* (Rambur) (Libellulidae) and *Lestes elatus* (Lestidae) were confined to Karunkaradu hill. *Diplacodes trivialis* (Rambur), *Orthetrum sabina* (Drury), *Pantala flavescens* (Fabricius), *Tramea basilaris* (Palisot de Beauvois) and *Tramea limbata* (Desjardins) (Libellulidae) were found in all hilly regions sampled. Odonata diversity was higher in Yercaud and lower in Pallikaradu according to Simpson's index (Table 3).

Discussion

Odonata in hill ecosystem is restricted when compared to those in plains, because only those species that can tolerate erratic environment would colonise hilly regions (Samways 1989; Carchini *et al.* 2005). Oppel (2005a,b) reported that Zygoptera was abundant in hilly regions than Anisoptera, which is in contrast with the present study which shows dominance of Anisoptera in the hilly regions, except Yercaud.

High shade cover and presence of water bodies favour the zygopteran population than Anisoptera (Schindler *et al.* 2003; Oppel 2005a). This might be the possible reason for

the abundance of Zygoptera in Yercaud and the reverse may be true for the abundance of Anisoptera in other hilly regions. Odonata of Family Libellulidae (Anisoptera) are common in plains and their diversity decreases with increase in altitude because fast flowing streams and rivers are not suitable for Libellulidae naiads, which require sluggish and weedy ponds (Samways, 1989). But Libellulidae was dominant at higher altitudes in the present study. Eurytopic (wide habitat tolerance) nature of Libellulidae (Stewart and Samways 1998;

Clausnitzer 2003; Oppel 2005a,b) might be responsible for their abundance when compared to other families, namely Coenagrionidae, Lestidae and Platycnemididae recorded in the present study.

Higher species richness and diversity of Odonata in Yercaud could be attributed to the vast area, variety of biotopes (temporary water bodies, river, stream, cascade) and high shade cover. This is in agreement with the findings of Samways (1989) in South Africa and Oppel (2005a) in Papua New Guinea.

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17. STATUS AND DISTRIBUTION OF *APPIAS LALAGE* BUTTERFLY (LEPIDOPTERA: PIERIDAE) IN THE WESTERN GHATS, SOUTH-WESTERN INDIA

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Much confusion surrounds the occurrence of *Appias lalage* Doubleday, 1842 (Lepidoptera: Pieridae: Pierinae), also known as the Spot Puffin butterfly, in the Western Ghats. The Western Ghats is a mountain chain that runs along the western coast of southern India, and it is one of the globally

recognized biodiversity hotspots. Its evergreen forest flora and fauna are isolated from the nearest Himalayan and north-east Indian forests by over 1,500 km of dry, mixed deciduous forests on the Deccan Plateau. Hence, the Western Ghats is a key feature of peninsular India from biogeographic,